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(54) **THREADED LENS COUPLING TO LED APPARATUS**

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(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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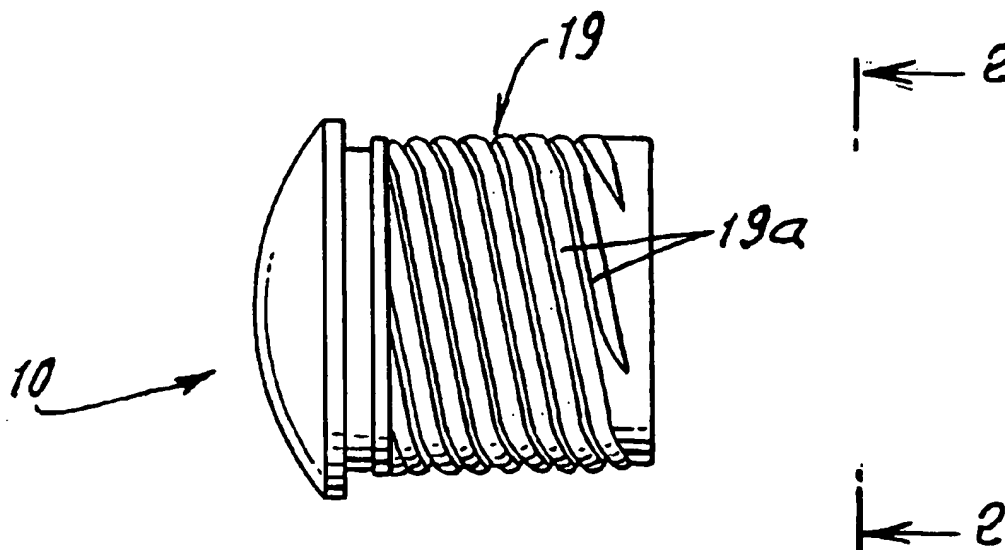
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(57) **ABSTRACT**

A lens adapted for securement to a holder, for transmission of light, comprising a lens body, defining an axis, threading on the lens body extending about said axis, for reception in threading associated with the holder.

20 Claims, 14 Drawing Sheets



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are received into two parallel female terminals 46 received into and carried by slots 47 in the connector 25a.

FIGS. 12-14 show progressive reception of a pin or lead 37 into a terminal 46. The tapered end 37a of the pin or lead penetrates into the tubular body 50 of the terminal, and between tapered guide 51 and internal barb 52. The guide and barb project laterally into the interior 50a of the body 50, with the guide slidably guiding the pin, and the barb 52 having an edge 52a riding along the side of the pin, with friction, to center the pin in the interior 50a. Edge 52a also gouges into the side of the pin to block endwise retraction or loosening of the pin from the terminal. Both 51 and 52 are resilient cantilever spring fingers. Wiring is retained to 46 at 46a.

Another form of LED unit is seen at 60 in FIGS. 11, 16, 16a and 16b. Unit 60 has a polygonal body 61, a domed end 62 from which light is emitted, and four pins 63 located at corners of a square. Those pins or leads are adapted to receive controlled electrical energization as from a circuit 64, to control different colored light emission from three LEDs in the unit, the fourth pin being a common or ground. Color emission from unit 60 can thereby be controlled, by light color mixing within 60, for emission from domed end 62. FIGS. 24 and 26 show pins or leads 63 endwise received within, and electrically connected, to four female terminals 65. The latter are in turn received in four slots 66 in the connector 25a. A control circuit appears at 64, as in FIG. 16. See also FIGS. 5 and 6.

The connector 25a of FIGS. 4-7 is configured to receive the pins of either type LED unit, 34 or 60, i.e. it has four slots 66 at corners of a square, to receive the four terminals 65 of a unit 60. It also has two slots 47 to receive terminals 46 of a unit 43. Slots 47 are located within the square (see FIG. 7) defined by slots 66. A highly versatile and compact connector 25a is thereby provided.

The connector terminals also provide a method of extracting heat from the LED, which prevents over heating and extends the operating life of the device.

I claim:

1. A lens adapted for securement to a holder, for transmission of light, comprising

- a) a lens body, defining an axis,
- b) threading on the lens body extending about said axis, for reception in threading associated with the holder,
- c) and including said holder that extends about the lens and is configured to expand in response to interfering engagement of the threading on the lens body with said threading associated with the holder, allowing thread slippage to limit tightening of the holder onto the lens,
- d) there being an axially compressible (grommet) on the lens to be resiliently compressed as the holder is tightened on the lens body, creating pressure and locking friction at thread to thread interengagement locations.

2. The lens of claim 1 wherein said threading on the lens body includes multiple threads extending about said axis.

3. The lens of claim 2 wherein said threads are foreshortened to allow for tightening into the threading associated with the holder in less than about one full turn of the lens relative to the holder.

4. The lens of claim 2 wherein said multiple threads on the lens body extend only part way about said axis.

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5. The lens of claim 2 wherein said multiple threads on the lens body extend only about half way about said axis.

6. The lens of claim 4 wherein there are six of said threads on the lens body.

7. The lens of claim 5 wherein there are six of said threads on the lens body.

8. The lens of claim 1 wherein said lens body is generally cylindrical, and said threading on said body extends peripherally of said body, and spirals about said axis.

9. The lens of claim 6 wherein said lens body is generally cylindrical, and said threading on said body extends peripherally of said body, and spirals about said axis.

10. The lens of claim 8 including a light transmitting cap on said body at one end thereof.

11. The lens of claim 1 wherein the threading associated with the holder has axial extent greater than the axial extent of said threading on the lens.

12. The lens of claim 11 wherein the threading associated with the holder includes multiple threads each having more than one full turn about the lens body, and the threading on the lens body includes multiple threads each having less than one full turn about said axis.

13. The lens of claim 11 wherein the threading associated with the holder includes six threads each having about two full turns about the lens body, and the threading on the lens body include six threads each having about one-half full turn about said axis.

14. The lens of claim 1 wherein the holder comprises a locking ring.

15. The lens of claim 1 including said holder, an LED or LEDs in end alignment with the lens and a plug carrying the LED or LEDs, within the holder.

16. A lens adapted for securement to a holder, for transmission of light, comprising

- a) a lens body, defining an axis,
- b) threading on the lens body extending about said axis, for reception in threading associated with the holder,
- c) and including said holder, an LED or LEDs in end alignment with the lens and a plug carrying the LED or LEDs, within the holder,
- d) and wherein the plug has pins, and there being multiple female terminals carried by the holder, with less than all of said terminals receiving said pins.

17. The lens of claim 16 wherein said holder extends about the lens and is configured to expand in response to interfering engagement of the threading on the lens body with said threading associated with the holder, allowing thread slippage to limit tightening of the holder onto the lens.

18. The lens of claim 16 wherein there are six of said female terminals, said pins on the plug being one of the following:

- i) two pins
- ii) four pins.

19. The lens of claim 16 including circuitry to provide selected current or voltage level energization to the LED or LEDs, via such pins.

20. The lens of claim 18 including circuitry to provide selected current or voltage level energization to the LED or LEDs, via such pins.

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